

## AMENDMENTS TO THE SPECIFICATION

*Please replace Paragraph [0012] with the following paragraph rewritten in amendment format:*

[0012] The present invention provides ceramic matrix composites (CMC) having superior properties at high temperatures. In one embodiment, the CMC comprises or is formed in part from a sol gel matrix or mixture with alumina powder mixed or blended into the matrix. The sol-gel matrix is an aqueous colloidal suspension of a metal oxide, preferably composed of particles in the size range of 4-150 nanometers and concentrations from about 10 wt% to about 25 wt% of the metal oxide. Preferably the metal oxide is alumina ( $\text{Al}_2\text{O}_3$ ), silica ( $\text{SiO}_2$ ) or alumina-coated silica.

*Please replace Paragraph [0013] with the following paragraph rewritten in amendment format:*

[0013] Methods for making the CMC of the present invention are also provided. The methods of the present invention comprise providing a sol-gel matrix mixture and mixing or blending alumina powder into the matrix mixture. The alumina powder preferably comprises from about 30 wt% to about 60 wt% of the blended mixture. In a preferred embodiment, the alumina powder that is mixed into the sol has a size less than or equal to about 1.5 microns and preferably preferably from about 0.1 microns to about 1.0 microns. If necessary, the pH of the mixture is adjusted to prevent gelling by adding acid or base to the mixture. The sol-gel mixture is then ball milled or high shear mixed to remove any soft agglomerates that form, producing a homogeneous suspension. In a further embodiment, this homogeneous solution is then infiltrated

using a doctor blade casting set up into a suitable ceramic cloth or fabric. Layers of infiltrated fabrics are laid up and placed in a vacuum bag, cured with or without pressure from a press or autoclave, then de-bagged and fired.

*Please replace Paragraph [0018] with the following paragraph rewritten in amendment format:*

[0018] In one embodiment, the ceramic matrix composition comprises or is formed in part from a sol-gel and alumina powder. In a preferred embodiment, the sol-gel is from about 40 wt% to about 70 wt% of the sol-gel and alumina mixture. Sol-gel is a material that can be used for making advanced materials including ceramics. There are two phases to the material, a liquid "sol", which is a colloidal suspension, and a solid "gel" phase. The transition from the liquid sol phase to the solid gel phase can be triggered by drying, heat treatment or increasing the pH to the basic range. The starting materials used in the preparation of the sol-gel are usually inorganic metal salts or metal organic compounds such as metal alkoxides. In a preferred embodiment of the present invention, the sol-gel comprises metal oxides, preferably alumina ( $\text{Al}_2\text{O}_3$ ), silica ( $\text{SiO}_2$ ) or alumina-coated silica and more preferably, alumina. In another preferred embodiment, the sol-gel comprises from about 10 wt% to about 25 wt% of the metal oxide. Sol-gels are commercially available (from Nalco Chemical or Vista Chemical Company) or can be made by methods known to those skilled in the art.

*Please replace Paragraph [0021] with the following paragraph rewritten in amendment format:*

**[0021]** The present invention also provides a method for producing a complex matrix composite, comprising the steps of blending or mixing alumina powder into a sol-gel ~~matrix mixture~~, treating the ~~matrix mixture~~ to produce a homogeneous suspension and infiltrating a ceramic cloth or fabric with the sol-gel and alumina mixture. In one embodiment, alumina powder is blended with or mixed into the sol-gel ~~matrix mixture~~. Preferably the amount of alumina is from about 30 wt% to about 60 wt%. The addition of alumina powder to the sol-gel matrix results in a mixture that is highly loaded with solids and yet has low viscosity.

*Please replace Paragraph [0022] with the following paragraph rewritten in amendment format:*

**[0022]** In another embodiment, the pH of the sol-gel mixture is adjusted to neutral pH, if necessary. For example, addition of the alumina to the sol-gel ~~matrix mixture~~ can result in a mixture that is more alkaline. This change in pH may trigger the undesired transition between the liquid "sol" into the solid "gel". To prevent this, acid may be added to balance the pH of the mixture. In a preferred embodiment, the amount of acid added to the mixture is from about 0.1 wt% to about 0.3 wt% and more preferably about 0.1 wt%. Suitable acids include, but are not limited to, nitric acid, hydrochloric acid, acidic acid or sulfuric acid. In a preferred embodiment, the acid is nitric acid.

*Please replace Paragraph [0024] with the following paragraph rewritten in amendment format:*

[0024] The resulting sol-gel and alumina mixture slurry is then infiltrated into a ceramic cloth or fabric using any of the commonly used infiltrating methods. Non-limiting examples of ceramic fabrics of 8 harness satin or plan weave are Nextel 720, Nextel 610, Nextel 550, Nextel 312, Nicalon (SiC), Altex or Almax. Preferably the ~~matrix mixture~~ is infiltrated using a doctor blade or a pinched roller set up. Both of these methods ensure complete infiltration of the ~~matrix mixture~~ into the fiber to form a reinforced matrix. The reinforced matrix is slightly dried to develop a tack and then draped on the desired complex tool shapes. The tool and the infiltrated fabric is vacuum bagged and heated to 350 °F. Heating to cure and rigidify the part is done in a vacuum bag with or without pressure (between 30-100 psi) from a press or an autoclave. The use of an autoclave is preferred using 100 psi. During heating the sol mixture starts to gel and the volatile components are removed. The sol-gel and alumina mixture bonds the alumina powder and the ceramic fiber assembly at just 350 °F. The parameters of gelling and drying steps are dependent upon many factors including the dimensions of the tool. In a further embodiment, the steps of infiltrating, gelling and drying can be repeated to achieve the desired density of the CMC.

*Please replace Paragraph [0027] with the following paragraph rewritten in amendment format:*

[0027] Alumina Sol (14N-4-25, Vista Chemicals) containing 25% solids of colloidal alumina ( $\text{Al}_2\text{O}_3$ ) in water was mixed in a blender with submicron alumina

powder (SM-8, Baikowski). The ~~matrix~~ mixture contained 57 wt% of alumina sol and 43 wt% of alumina powder. Several drops of nitric acid (about 0.1%) were added to the ~~matrix~~ mixture to balance the pH. The matrix was then ball milled with alumina media for 4 hours before infiltrating into the fabric.

*Please replace Paragraph [0028] with the following paragraph rewritten in amendment format:*

[0028] The ~~matrix~~ mixture was infiltrated into the fabric using a doctor blade or a pinched roller set up. This allowed the ~~matrix~~ mixture to fully infiltrate into the fabric. After fabric infiltration, the ~~matrix~~ mixture was slightly dried to develop tack. The material was then draped on complex tools, vacuum bagged having standard bleeders and breathers used in the organic composite industry and autoclaved to 350 °F. After exposing the matrix to heat to set the matrix, the vacuum bag and tools were removed. The resulting part was post cured free standing between 1500 °F and 2300 °F, preferably 2000 °F.

*Please replace Paragraph [0029] with the following paragraph rewritten in amendment format:*

[0029] Alumina-coated Silica Sol (1056, Nalco Chemicals) containing 20% solids of colloidal silica ( $\text{SiO}_2$ ) coated with alumina ( $\text{Al}_2\text{O}_3$ ) in water was mixed in a blender with submicron alumina powder (SM-8, Baikowski). The ~~matrix~~ mixture contained 57 wt% of alumina-coated silica sol and 43 wt% of alumina powder. Several drops of nitric acid (about 0.1%) were added to the ~~matrix~~ mixture to balance the pH. The ~~matrix~~

mixture was then ball milled with alumina media for 4 hours before infiltrating into the fabric. The fabric was infiltrated by the same method as described in Example 1.

*Please replace Paragraph [0030] with the following paragraph rewritten in amendment format:*

[0030] Silica Sol (2327, Nalco Chemicals) containing 20% solids of colloidal silica ( $\text{SiO}_2$ ) in water was mixed in a blender with submicron alumina powder (SM-8, Baikowski). The ~~matrix~~ mixture contained 57 wt% of silica sol and 43 wt% of alumina powder. Several drops of nitric acid (about 0.1%) were added to the ~~matrix~~ mixture to balance the pH. The matrix was then ball milled with alumina media for 4 hours before infiltrating into the fabric. The fabric was infiltrated by the same method as described in Example 1.